BOOKS:
Kwan .L. 2000, Comprehensive Biology (3rd),Singapore; Federal Publication
Mackean.D, GCE O Level Biology, Oxford University Press

Cambridge O level Biology
Syllabus code 5090

1. ASSESSMENT AT A GLANCE
All candidates enter for three papers – Papers 1 and 2 and Paper 6.

Paper 1: Multiple Choice 1 hour
40 compulsory multiple-choice questions. The questions involve four response options.
40 marks

Paper 2: Theory 1 hour 45 minutes
The paper has three sections.
Section A has 50 marks and consists of a small number of compulsory, structured questions.
Section B has 20 marks and consists of two compulsory questions. Each question is worth 10 marks.
Section C carries 10 marks and candidate must choose one from a choice of two questions.
80 marks

Paper 6 Alternate to Practical 1 hour
A written paper of questions designed to test past experience of practical work.
40 marks

2. SYLLABUS AIMS:
The aims provide the educational purposes of following a course in this subject. Some of these aims are reflected in the assessment objectives; others are not because they cannot readily be translated into objectives that can be assessed. The aims are not listed in an order of priority.
The aims are to:

- provide, through well designed studies of experimental and practical biological science, a worthwhile educational experience for all students, whether or not they go on to study science beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge to
- become confident citizens in a technological world, able to take or develop an informed interest in matters of scientific import;
- recognize the usefulness, and limitations, of scientific method and to appreciate its applicability in other disciplines and in everyday life;
- be suitably prepared and stimulated for studies beyond Cambridge O Level in pure sciences, in applied sciences or in science-dependent vocational courses.
- develop abilities and skills that
- are relevant to the study and practice of science;
- are useful in everyday life;
- encourage efficient and safe practice;
- encourage effective communication.
- develop attitudes relevant to science such as
  - concern for accuracy and precision;
  - objectivity;
  - integrity;
  - enquiry;
  - initiative;
  - inventiveness.
- stimulate interest in and care for the local and global environment.
- promote an awareness that
  - the study and practice of science are co-operative and cumulative activities that are subject to social, economic, technological, ethical and cultural influences and limitations;
  - the applications of science may be both beneficial and detrimental to the individual, the community and the environment;
  - science transcends national boundaries and that the language of science, correctly and rigorously applied, is universal.

MONTHLY SYLLABUS

<table>
<thead>
<tr>
<th>Month</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>August</td>
<td>• Homeostasis</td>
</tr>
<tr>
<td></td>
<td>• Excretion</td>
</tr>
<tr>
<td>September</td>
<td>• Sensitivity and movement in plants</td>
</tr>
<tr>
<td></td>
<td>• Support; movement and locomotion in animals</td>
</tr>
<tr>
<td>October</td>
<td>• Co-ordination and response</td>
</tr>
<tr>
<td></td>
<td>• Animal senses and behavior</td>
</tr>
<tr>
<td>November</td>
<td>• Animal senses and behavior</td>
</tr>
<tr>
<td>December</td>
<td>• Revision for midterm exams</td>
</tr>
<tr>
<td>January</td>
<td>• Midterm exams</td>
</tr>
<tr>
<td>February</td>
<td>• Ecology</td>
</tr>
<tr>
<td></td>
<td>• Parasites, diseases and immunity</td>
</tr>
<tr>
<td>March</td>
<td>• Micro organism and biotechnology</td>
</tr>
<tr>
<td></td>
<td>• Evolution and natural selection</td>
</tr>
<tr>
<td></td>
<td>• Revision for mock exams</td>
</tr>
<tr>
<td></td>
<td>• Mock exams</td>
</tr>
</tbody>
</table>

SYLLABUS CONTENT:

<table>
<thead>
<tr>
<th>Content/learning outcomes:</th>
<th>1. Excretion in humans</th>
<th>Enhancement:</th>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Define <em>excretion</em> as the removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration) and substances in excess of requirements. Substances should include carbon dioxide, urea and salts</td>
<td>• Outline the structure of a kidney (cortex, medulla, and the start of the ureter) and outline the structure and functioning of a kidney tubule including:</td>
<td>• D.G. Mackean pg (131-140)</td>
<td></td>
</tr>
<tr>
<td>• Describe the function of the kidney in terms of the removal of urea and excess water and the reabsorption of glucose and some salts (details of kidney structure and nephron are not required)</td>
<td>• Role of renal capsule in filtration from blood of water, glucose, urea and salts</td>
<td>• Longman biology pg(106-119)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Role of tubule in reabsorption of glucose, most of the water and some salts back into the blood, leading to concentration of urea in the urine as well as loss of excess water and salts</td>
<td>• Mary Jones Biology pg(137-140)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• W.R. Pickering pg(113-118)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Comprehensive Biology pg(149-161)</td>
<td></td>
</tr>
</tbody>
</table>
- State the relative positions of ureters, bladder and urethra in the body
- State that urea is formed in the liver from excess amino acids
- State that alcohol, drugs and hormones are broken down in the liver
- Explain dialysis in terms of maintenance of glucose and protein concentration in blood and diffusion of urea from blood to dialysis fluid
- Discuss the application of dialysis in kidney machines
- Discuss the advantages and disadvantages of kidney transplants, compared with dialysis

<table>
<thead>
<tr>
<th>Content/learning outcomes</th>
<th>Enhancement</th>
<th>Reference Books</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Homeostasis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define homeostasis as the maintenance of a constant internal environment;</td>
<td>Explain the concept of control by negative feedback</td>
<td>W.R.Pickering pg(110-118)</td>
</tr>
<tr>
<td>Explain the concept of control by negative feedback;</td>
<td>Describe the control of the glucose content of the blood by the liver, and by insulin and glucagon from the pancreas</td>
<td>Comprehensive Biology pg(157-163)</td>
</tr>
<tr>
<td>Identify, on a diagram of the skin, hairs, sweat glands, temperature receptors, blood vessels and fatty tissue;</td>
<td></td>
<td>Mary Jones Biology pg(143-150)</td>
</tr>
<tr>
<td>Describe the maintenance of a constant body temperature in humans in terms of insulation and the role of temperature receptors in the skin, sweating, shivering, blood vessels near the skin surface and the coordinating role of the brain.</td>
<td></td>
<td>Longman biology pg(104-108)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D.G Mackean pg(137-140)</td>
</tr>
</tbody>
</table>
### 3.1 Nervous control in humans

**Content/learning outcomes:**
- Describe the human nervous system in terms of the central nervous system (brain and spinal cord as areas of coordination) and the peripheral nervous system which together serve to coordinate and regulate body functions.
- Identify motor (effector), relay (connector) and sensory neurons from diagrams.
- Describe a simple reflex arc in terms of sensory, relay and motor neurons, and a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with responses.
- State that muscles and glands can act as effectors.
- Describe the action of antagonistic muscles to include the biceps and triceps at the elbow joint.
- Define sense organs as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals.
- Describe the structure and function of the eye, including accommodation and pupil reflex.

**Enhancement:**
- Distinguish between voluntary and involuntary actions.
- Distinguish between rods and cones, in terms of function and distribution.

**Reference Books**
- D.G Mackean pg (163-170)
- Longman biology pg(63-77)
- Mary Jones Biology pg(152-170)
- W.R.Pickering pg(88-108)
- Comprehensive Biology pg(190-210)

### 3.2 Hormones

- Define a hormone as a chemical substance, produced by a gland, carried by the blood, which alters the activity of one or more specific target organs and is then destroyed by the liver.
- State the role of the hormone adrenaline in chemical control of metabolic activity, including increasing the blood glucose concentration and pulse rate.
- Give examples of situations in which adrenaline secretion increases.
- Compare nervous and hormonal control systems.

- Discuss the use of hormones in food production.

**Reference Books**
- D.G Mackean pg(169-173)
- Longman biology pg(79-87)
- Mary Jones Biology pg(169-170)
- Comprehensive Biology pg(200-209)

### 3.3 Tropic responses

- Define and investigate geotropism (as a response in which a plant grows towards or away from gravity) and phototropism (as a response in which a plant grows towards or away from the direction from which light is coming).

- Explain the chemical control of plant growth by auxins including geotropism and phototropism in terms of auxins regulating differential growth, and the effects of synthetic plant hormones used as weed killers.

**Reference Books**
- Longman biology pg(143-149)
- Comprehensive Biology pg(181-190)
### 4. Support, movement and locomotion

**Content/learning outcomes:**
- Identify and describe, from diagrams, photographs and real specimens, the main bones of the forelimb of a mammal;
- Describe the type of movement permitted by the ball and socket joint and the hinge joint of the forelimb;
- Describe the action of the antagonistic muscles at the hinge joint.

**Enhancement:**

**Reference Books**
- D.G Mackean pg (152-157)
- Longman biology pg(89-102)
- W.R.Pickering pg(120-130)
- Comprehensive Biology pg(216-230)

### 6. Microorganisms and biotechnology

**Content/learning outcomes:**
- List the main characteristics of the following groups: viruses, bacteria and fungi;
- Outline the role of microorganisms in decomposition;
- Explain the role of yeast in the production of bread and alcohol;
- Outline the role of bacteria in yoghurt and cheese production;
- Describe the use of fermenters for large-scale production of antibiotics and single cell protein;
- Describe the role of the fungus *Penicillium* in the production of penicillin.

**Enhancement:**
- Preparation of yogurt, cottage cheese, sauces will be done in nutrition lab

**Reference Books**
- D.G Mackean pg (326-332)
- Longman biology pg(272-285)
- W.R.Pickering pg(278-318)

### 7. Relationships of organisms with one another and with the environment

**Content/learning outcomes:**
- State that the Sun is the principal source of energy input to biological systems;
- Describe the non-cyclical nature of energy flow;
- Define the following terms and establish the relationship of each in food webs: **Producer**, **consumer**, **herbivore**, **carnivore**, **decomposer**, **food chain**;
- Explain why food chains usually have fewer than five trophic levels
- Explain why there is an increased efficiency in supplying green plants as human food and that there is a relative inefficiency, in terms of energy loss, in feeding crop plants to animals

**Enhancement:**

**Reference Books**
- D.G Mackean pg (222-259)
- Longman biology pg(151-171)
- Mary Jones Biology pg(234-250)
- W.R.Pickering pg(242-276)
<table>
<thead>
<tr>
<th>Describe energy losses between trophic levels and infer the advantages of short food chains;</th>
<th>Describe the nitrogen cycle in terms of:</th>
<th>Comprehensive Biology pg(299-321)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe and interpret pyramids of numbers and of biomass, describes and state the importance of the carbon cycle;</td>
<td>• the role of microorganisms in providing usable nitrogen-containing substances by decomposition and by nitrogen fixation in roots</td>
<td></td>
</tr>
<tr>
<td>describe the nitrogen cycle in making available nitrogen for plant and animal protein, including the role of bacteria in nitrogen fixation, decomposition and nitrification (details of gentrification and the names of individual bacteria are not required);</td>
<td>• the absorption of these substances by plants and their conversion to protein</td>
<td></td>
</tr>
<tr>
<td>Understand the role of the mosquito as a vector of disease;</td>
<td>• followed by passage through food chains, death, decay</td>
<td></td>
</tr>
<tr>
<td>Describe the malaria pathogen as an example of a parasite and describe the transmission and control of the malarial pathogen (details of the life cycle of the pathogen are not required);</td>
<td>• nitrification and denitrification and the return of nitrogen to the soil or the atmosphere (names of individual bacteria are not required)</td>
<td></td>
</tr>
<tr>
<td>Describe the effects of humans on the ecosystem with emphasis on examples of international importance (tropical rain forests, oceans and important rivers);</td>
<td>• Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the oxygen and carbon dioxide concentrations in the atmosphere</td>
<td></td>
</tr>
</tbody>
</table>

### 7.1 Population size

<table>
<thead>
<tr>
<th>Define population as a group of organisms of one species, living in the same area at the same time</th>
<th>Explain the factors that lead to the lag phase, exponential (log) phase and stationary phase in the sigmoid curve of population growth making reference, where appropriate, to the role of limiting factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State the factors affecting the rate of population growth for a population of an organism (limited to food supply, predation and disease), and describe their importance</td>
<td>Explain the factors that lead to the lag phase, exponential (log) phase and stationary phase in the sigmoid curve of population growth making reference, where appropriate, to the role of limiting factors</td>
<td></td>
</tr>
<tr>
<td>Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources</td>
<td>Explain the factors that lead to the lag phase, exponential (log) phase and stationary phase in the sigmoid curve of population growth making reference, where appropriate, to the role of limiting factors</td>
<td></td>
</tr>
<tr>
<td>Describe the increase in human population size and its social implications</td>
<td>Explain the factors that lead to the lag phase, exponential (log) phase and stationary phase in the sigmoid curve of population growth making reference, where appropriate, to the role of limiting factors</td>
<td></td>
</tr>
<tr>
<td>Interpret graphs and diagrams of human population growth.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 7.2 Human influences on the ecosystem

- Outline the effects of humans on ecosystems, with emphasis on examples of international importance (tropical rain forests, oceans and important rivers)

- D. G. Mackean pg (234-250)
- W. R. Pickering pg (268-276)
- Comprehensive Biology pg (321-330)

### 7.4 Pollution

- Describe the undesirable effects of pollution to include:
  - water pollution by sewage and chemical waste
  - air pollution by sulfur dioxide
  - air pollution by greenhouse gases (carbon dioxide and methane)
  - pollution due to pesticides including insecticides and herbicides
  - pollution due to nuclear fall-out

- Discuss the effects of non-biodegradable plastics in the environment

- Discuss the causes and effects on the environment of acid rain, and the measures that might be taken to reduce its incidence

- Explain how increases in greenhouse gases (carbon dioxide and methane) are thought to cause global warming

### 7.5 Conservation

- Describe the need for conservation of:
  - species and their habitats
  - natural resources (limited to water and nonrenewable materials including fossil fuels)

- Explain how limited and non-renewable resources can be recycled (including recycling of paper and treatment of sewage to make the water that it contains safe to return to the environment or for human use)

### Resource list

<table>
<thead>
<tr>
<th>Author</th>
<th>Title and Date</th>
<th>Publisher</th>
<th>ISBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary Jones</td>
<td>O Level Biology (2003)</td>
<td>Oxford University Press <a href="http://www4.oup.co.uk">http://www4.oup.co.uk</a></td>
<td>0195799828</td>
</tr>
</tbody>
</table>

### Useful websites:

- American Lung Association [www.lungusa.org/diseases](http://www.lungusa.org/diseases)
- CELLS alive [www.cellsalive.com](http://www.cellsalive.com)
- GCSE Bitesize Revision in biology [www.bbc.co.uk/schools/gcsebitesize/biology](http://www.bbc.co.uk/schools/gcsebitesize/biology)
- Middle school science [www.middleschoolscience.com](http://www.middleschoolscience.com)
- SAPS (Science and Plants for Schools) [www.saps.plantsci.cam.ac.uk](http://www.saps.plantsci.cam.ac.uk)
- School science [www.schoolscience.co.uk](http://www.schoolscience.co.uk)
- The Science Spot [www.sciencespot.net](http://www.sciencespot.net)